Section 4.9
Noise

This section provides an update on existing noise conditions in the study area. It has been updated to reflect new noise monitoring completed in October 2003, and new noise impact information and abatement analyses based on application of the revised 2003 FHWA traffic noise model (TNM), version 2.1.

4.9.1 Approach and Methodology

4.9.1.1 Changes since June 2000 Final EIS

To update the affected environment and environmental consequences information associated with noise in the study area, Sections 3.9 and 4.9 of the Final EIS were reviewed to determine what changes had occurred since publication of the Final EIS. The study area for the noise section encompassed a corridor spanning approximately 457 m (1,500 ft) on each side of the proposed build alternative alignments; the northern and southern boundaries of the study area are defined in Section 4.0.1, *Study Area*. The 457-m (1,500-ft) study area width is consistent with the validation limits of the TNM, which are described in more detail in the following text.

The following section summarizes the approach and methodology used to incorporate information generated from the updated TNM and to reevaluate proposed noise abatement measures. This section also provides supplemental information on how noise is generated and measured, as well as the federal and state regulatory requirements that govern noise abatement criteria. It should be noted that noise impacts on 4(f)/6(f) resources, including the Farmington Bay Waterfowl Management Area (FBWMA), the Jordan River Off-Highway Vehicle (OHV) Center, and Bountiful City Pond, are discussed in Chapter 5 of this document. A brief discussion of noise abatement measures for these resources is included below in 4.9.3.2, *Noise Abatement Measures*. Noise impacts on wildlife are discussed in Section 4.13 of this document.

4.9.1.2 Changes since Draft Supplemental EIS

Changes have been made to the calculations of noise impacts since the Draft Supplemental EIS was published in December 2004. Those changes were made because the total number of affected residences within the 65-dB contour has been revised to include platted lots.[1] See Section 4.9.3.1, *Operational Noise Impacts.*

[1] A platted lot is an individual lot within a subdivided parcel legally dedicated for development.

4.9.1.3 Background Information on Noise

As described in the Final EIS, sound travels through the air as waves of minute air pressure fluctuations caused by vibration. Sound level meters are used to measure the actual pressure fluctuation caused by sound waves, taking into consideration different sound frequency ranges. The decibel scale used to describe sound is a logarithmic scale that accounts for the large range of sound pressure levels. The A-weighted decibel scale (dB[A]) is the composite decibel scale most widely used to approximate the way the human ear responds to noise levels. Table 3-20 in the Final EIS lists typical A-weighted noise levels for various types of sound sources.

Varying noise levels are often described in terms of the equivalent sound level (Leq). Equivalent sound levels are used to develop single-value descriptions of average noise exposure over stated periods of time. The Leq data used for these average noise exposure descriptors are generally based on A-weighted sound-level measurements. Most often, units of hourly Leq values are used to describe traffic noise.

The nature of decibel (dB) scales is such that individual dB ratings for different noise sources cannot be added directly to give the sound level for the combined noise source. Examples of this are given below.

- Two noise sources producing equal dB ratings at a given location produce a combined noise level 3 dB greater than either sound alone.
- When two noise sources differ by 10 dB, the combined noise level is 0.4 dB greater than the louder source alone.
- People generally perceive a 10-dB increase in a noise source as a doubling of loudness. For example, a 70-dB sound level is perceived by an average person as twice as loud as a 60-dB sound.
- People generally cannot detect differences of 1 to 2 dB between noise sources. Under ideal listening conditions, differences of 2 or 3 dB can be detected by some people. A 5-dB change would probably be perceived by most people under normal listening conditions.

When distance is the only factor considered, sound levels from isolated point sources of noise typically decrease by about 6 dB for every doubling of distance from the noise source. When the noise source is a continuous line (for example, vehicle traffic on a highway), sound levels decrease by about 3 dB for every doubling of distance away from the roadway. In traffic studies, an attenuation rate of 4.5 dB per doubling of distance is often used when the roadway is at ground level and the intervening ground is effective in absorbing sound (for example, ground vegetation, scattered trees, clumps of bushes). When the roadway is elevated, 3-dB noise attenuation per doubling of distance is used because the sound-absorbing effects of the intervening ground are limited.

Noise levels at different distances can also be affected by factors other than the distance from the noise source. Topographic features and structural barriers that absorb, reflect, or scatter sound waves can increase or decrease noise levels. Atmospheric conditions (wind speed and direction, humidity levels, and temperatures) can also affect the degree to which sound is attenuated over distance.

Reflections off topographical features or buildings can sometimes result in higher sound levels (lower sound attenuation rates) than would be normally expected. Temperature inversions and altitudinal changes in wind conditions can also diffract and focus a sound wave to a location at considerable distance from the noise source. Focusing effects are usually noticeable only for very intense noise sources, such as blasting operations. As a result, the existing noise environment can be highly variable depending on local conditions.

4.9.1.4 Methods Used to Update Noise Analysis

The following methods were used to update the noise analysis presented in the Final EIS. Supplemental information regarding noise monitoring and application of the TNM is described in more detail below.

- Existing activities, developed land, and undeveloped land for which development is planned, designed, or programmed and that could be affected by noise from the proposed build alternatives were identified from field surveys and aerial photographs of the alignment corridor.

- Short-term (15-minute) sound level measurements typical of existing conditions were collected at selected representative locations throughout the study area to characterize the existing noise environment adjacent to the proposed alignments.

- Potential noise impacts associated with construction and operation of the proposed build alternatives were predicted using the updated TNM, version 2.1, which was approved by FHWA and UDOT in February 2003.[2]

- Project related noise impacts were identified at residential and recreational locations within about 457 m (1,500 ft) of each build alternative alignment. These impacts were identified using the relative and absolute criteria specified in Title 23, Part 772 of the Code of Federal Regulations (23CFR 772), "Procedures for Abatement of Highway Traffic Noise," and UDOT's Noise Abatement Policy (UDOT 08A2-1) (see Section 4.9.1.5 below).

- Where appropriate, noise abatement measures for reducing or eliminating noise impacts were identified and evaluated using UDOT guidelines and the Noise Abatement Policy for determining feasibility, reasonableness, and cost-effectiveness.

Noise Monitoring

As stated above, short-term (15-minute) noise monitoring was conducted at 17 locations throughout the study area. Noise monitoring was conducted between 11:00 a.m. and 4:00 p.m. on October 2, 3, and 7, 2003. During the monitoring period, the skies were clear and the wind was minimal. Sound level monitoring locations are shown in Figures 4.9-1 through 4.9-6, and the results of the monitoring effort are presented in Section 4.9.2.2 of this document.

Monitored sound levels were also used to calibrate the revised TNM prior to modeling with project-related traffic volumes. Because the proposed action would be a new alignment constructed primarily

[2] The location of the proposed berm was not incorporated into the TNM because it was located in an area that had no residential receptors at the time the model was run. As described in Section 4.1, *Land Use*, development has recently begun on some of the platted lots in the study area. Noise attenuation benefits associated with the berm would only be applicable to those lots and proposed future development within the study area for which construction has not begun.

through undeveloped terrain, noise monitoring locations were selected that represent areas adjacent to the proposed alignments without being unduly influenced by traffic from major nearby sources of noise, such as I-15. Ambient noise monitoring was conducted using a Larson-Davis model 712 sound-level meter. Instrument calibration was verified with a Larson-Davis acoustic calibrator before each measurement session. At each monitoring position, the meter was held by a tripod approximately 1.5 m (5 ft) above the ground.

Traffic Noise Model

As stated above, project-related traffic noise levels were modeled using version 2.1 of the TNM. The TNM estimates acoustic intensity at receiver locations based on the level of sound energy generated from a series of straight-line roadway segments. Where appropriate, the effects of local shielding from existing structures, vegetation, terrain, and other adjustment factors were included in the model to provide a higher level of detail and accuracy.

Because the proposed action would extend over a relatively large area, much of which is undeveloped, the focus of the analysis was on those areas with a substantial number of residential dwellings. For each alternative alignment, the center of the travel lanes was delineated in the model. Noise levels were modeled to reflect traffic conditions expected in 2020 after the project is completed. Vehicle volumes and speeds modeled for the alternative alignments were based on level of service (LOS) C operations (1,680 vehicles per hour per lane), which represent the typical worst-case noise conditions where per-lane vehicle volumes are maximized under free-flow travel speeds (105 kilometers per hour (kph) (65 miles per hour [mph]) for this analysis). This modeling methodology results in worst-case noise impacts and may overstate noise impacts if traffic operations are worse than LOS C (i.e., LOS D, E, or F) where speeds are slower, or if traffic operations are LOS A and B where there is less traffic operating at higher speeds.

The noise model also requires assumptions about the percentage of automobiles (two-axle, four-tire vehicles), medium trucks (two-axle, six-tire vehicles), and heavy trucks (three or more axles) using each individual roadway. Vehicle mixes vary depending on the roadway segment, time of day, and proximity to commercial or light-industrial land uses. Since there is no existing roadway, a vehicle mix of 90 percent automobiles, 5 percent medium trucks, and 5 percent heavy trucks was assumed on the mainline for each alternative alignment.[3] This vehicle mix is similar to what has been observed on I-15 for other projects.

Limitations of the Traffic Noise Model

Validation studies have been conducted for the TNM out to distances of about 396 m (1,300 ft) from a given roadway. However, it is acknowledged that TNM predication accuracy decreases with increasing distances due largely to the effects of wind and temperature gradients and approximations in the ground propagation algorithms. Most highway traffic noise analyses consider receptor locations within 30 to 91 m (100 to 300 ft) of the highway right-of-way. Project noise analyses are normally limited to distances of less than 305 m (1,000 ft) from the roadway. Some state Departments of Transportation (DOTs) will not model any distance greater than 152 m (500 ft) from a roadway, and FHWA is not aware of any noise model that will be accurate for distances of 610 to 914 m (2,000 to 3,000 ft) from a roadway.

[3] Vehicle mix used for the noise analysis was based on videotaped traffic volumes for I-15 during representative traffic periods.

As described above, the study area for the noise analysis encompasses a corridor 457 m (1,500 ft) wide on either side of the centerline of the proposed build alternatives. This study area boundary is consistent with the validation limits of the TNM and provides a conservative and accurate estimate of potential noise impacts on receptors within that area.

4.9.1.5 Regulatory Requirements

Federal Highway Administration Noise Standards

As described in the Final EIS, the Federal Noise Control Act of 1972 (Public Law 92-574) requires that all federal agencies administer their programs in a manner that promotes an environment free from noises that could jeopardize public health or welfare. 23 CFR 772 implements this requirement and specifies procedures and criteria for evaluating noise impacts associated with highway projects, and for determining whether such impacts are sufficient to justify funding noise abatement measures. FHWA noise abatement criteria (NAC) specified in 23 CFR 772 are summarized in Table 3-21 in the Final EIS.

Under 23 CFR 772, a traffic noise is considered an impact when a predicted traffic noise level approaches or exceeds the NAC (see Table 3-21 in the Final EIS) or when the predicted traffic noise level substantially exceeds the existing noise levels. 23 CFR 772 does not specifically define what constitutes a substantial increase or the term “approach”; instead, it leaves interpretation of these terms to the states (see *Utah State Noise Guidelines*). Finally, FHWA NEPA guidance (Federal Highway Administration 1995) states that the significance of noise impacts identified under 23 CFR 772 must be identified based on the context and intensity of the noise impacts, where *context* refers to the extent of the noise impact (i.e., number of affected residences) and the existing noise environment, and *intensity* refers to the noise levels associated with the impact (i.e., predicted absolute noise level and predicted increase over existing noise level). Noise abatement measures that are reasonable and feasible and likely to be incorporated into the project, as well as noise impacts for which no apparent solution is available, must be identified before adoption of the final environmental document for a project.

This information has not changed since publication of the Final EIS.

Utah State Noise Guidelines

UDOT has established a Noise Abatement Policy (UDOT 08A2-1) that details highway traffic noise prediction requirements, noise analysis procedures, and noise abatement criteria consistent with the requirements of 23 CFR 772. According to this policy, a design year noise level within 2 dB(A) of the NAC is considered to approach the NAC, a design year noise level greater than or equal to the NAC is considered to exceed the NAC, and a 10-dB(A) increase over existing noise levels is considered to substantially exceed the NAC. This information has not changed since publication of the Final EIS. It should be noted that in 2004, UDOT published an updated Noise Abatement Policy. However, since the noise analysis conducted for this Supplemental EIS was initiated prior to the date of publication of the revised policy, the policy that was in effect in April 2000 was used to analyze abatement for traffic-related noise impacts.

4.9.2 Affected Environment

This section provides updated noise monitoring data that was collected along the proposed action corridor in October 2003.

4.9.2.1 Existing Noise Levels

Land uses adjacent to and within the study area encompass a mix of residential, commercial, agricultural, public recreational, and light-industrial activities (see Section 4.1, *Land Use.*) Although many of these land uses exhibit low background noise levels (e.g., open space agricultural land, pastureland, wetlands), there are several specific land uses in the area that have the potential to contribute more to ambient noise levels. Examples of such land uses are listed below.

- The Davis County sewage treatment plant, located at the west end of 1200 North in Woods Cross.
- The Bountiful Sanitary Landfill, located at the western edge of Pages Lane near West Bountiful.
- The Davis County Fairgrounds, located southeast of the 100 North and 1100 West intersection.
- The Salt Lake City International Airport.
- Light industrial businesses in the study area, including the South Bountiful Auto Salvage Yard and Quality Plating Facility, located at the west end of 2425 South in Woods Cross, and a small industrial area located south of State Street, adjacent to I-15, in Farmington.

As described above in Section 4.9.1.2, short-term noise monitoring was conducted at 17 locations in the study area (Figures 4.9-1 through 4.9-6). These locations were selected to represent residential and recreational locations in the study area where people could spend a substantial amount of time and where the impacts of the proposed action would be experienced. These areas do not necessarily represent atypically quiet or loud locations.

Table 4.9-1 shows the results of the noise monitoring at each location. Because large portions of each build alternative would be constructed in relatively undeveloped terrain in an area of few background noise sources, background noise levels are generally low throughout the corridor. Noise sources in the undeveloped portion of the alignment include farming operations, vehicle pass-by trips on minor arterials, and occasional aircraft overflights.

As illustrated in Table 4.9-1, existing noise levels met or exceeded the UDOT noise abatement criteria of 65 dB(A) at one location (ML-1 in Figure 4.9-1) due to the proximity of the monitoring site to I-215. Monitored noise levels at all other locations were below the residential NAC and ranged from 39 to 62 dB(A).

Table 4.9-1 Existing Noise Levels October 2003

Monitoring Location	Site Description	Date	L_{eq}	Approaches or Exceeds Residential NAC, 67 dB(A) or above
ML-1	Farmstead near I-215	10/07/2003	67	Yes
ML-2	Residences east of 2200 West	10/07/2003	52	No
ML-3	Residences on Century Farm Road east of 2200 West	10/07/2003	55	No
ML-4	Commercial/industrial site at 1100 West Center Street	10/02/2003	58	No
ML-5	West end of 900 North	10/02/2003	48	No
ML-6	500 South	10/03/2003	51	No
ML-7	1200 North; residences east of sewage treatment plant	10/02/2003	43	No
ML-8	Picnic area at Bountiful City Pond	10/02/2003	46	No
ML-9	Residences north of Porter Lane	10/02/2003	39	No
ML-10	Residences on Porter Lane	10/02/2003	48	No
ML-11	Undeveloped area at south end of 650 West	10/03/2003	45	No
ML-12	Residences on Glovers Lane	10/03/2003	59	No
ML-13	Glovers Lane Park	10/03/2003	56	No
ML-14	Residences east end of 350 South cul-de-sac	10/03/2003	62	No
ML-15	Residences, Farmington Ranch 100 South 1800 West	10/03/2003	45	No
ML-16	Burke (Park) Lane, north of residences	10/03/2003	57	No
ML-17	LDS Church, Farmington	10/03/2003	50	No

4.9.3 Environmental Consequences and Mitigation Measures

This section discusses updated operational noise impacts associated with the proposed build alternatives based on new noise monitoring, noise modeling, and abatement analyses completed since publication of the Final EIS. As described in Section 4.9.1.3, 23 CFR 772 specifies procedures and criteria for evaluating noise impacts associated with highway projects, and for determining whether such impacts are sufficient to justify funding noise abatement measures. In addition, UDOT has established a Noise Abatement Policy (UDOT 08A2-1) that is consistent with the 23 CFR 772 federal mandate that details highway traffic noise prediction requirements, noise analysis procedures, and noise abatement criteria. Both the federal regulations and the state guidance were used to assess whether operational noise impacts on residential and recreational receptors would require noise abatement to mitigate potential impacts.

See Section 4.20, *Construction Impacts*, for a discussion of construction-related noise impacts.

4.9.3.1 Operational Noise Impacts

Both modeled noise levels ("model receptors" designated R in Figures 4.9-1 through 4.9-6) and monitored noise levels from field measurements ("monitored levels" designated ML in Figures 4.9-1 through 4.9-6) were used in the noise model to characterize project-related noise impacts in the study area (i.e., both model locations and field locations were coded as receptor locations in the model). Data collected from the model was then used to determine whether predicted noise levels associated with the proposed action would approach or exceed the applicable residential NAC (65 dB[A]) or result in a 10-dB(A) increase over existing noise levels (a substantial increase according to UDOT criteria).

To ensure model accuracy, monitored noise levels were calibrated to within 2 dB(A) of the field measurements in those locations where existing traffic noise from I-15 and I-215 were predominant noise sources. In those locations where there were no existing sources of noise, the monitored noise levels were used as the background noise level.

Operational noise impacts associated with the No-Build Alternative and build alternatives are described below and summarized in Table 4.9-2. These impacts are described based on representative receiver locations that would potentially be affected by traffic volumes associated with the build alternatives, and have been categorized into five segments to facilitate their identification. These five segments, and some of the typical land uses associated with them, are summarized below.

- **Segment 1: I-215 to 900 North**. As illustrated in Figure 4.9-1, the southern portion of this segment is characterized primarily by undeveloped terrain, with scattered residences located in the general vicinity of I-215 (ML-1, ML-2, ML-3, R-1, and R-2). Just north of Center Street, a new residential development, the Foxboro residential development (R-3 through R-8), is under construction. Between the northern limit of the Foxboro development and 900 North, land use is either undeveloped or industrial in nature. The Davis County sewage treatment plant (south) and the Jordan River Raceway are also located in Segment 1.

- **Segment 2: 900 North to 1200 North**. This segment is characterized primarily by undeveloped terrain, as illustrated in Figure 4.9-2. There are scattered residences west of 1800 West just south of 500 South (ML-6), as well as five residences on 1200 North (ML-7), east of the Davis County sewage treatment plant (north).

- **Segment 3: 1200 North to Parrish Lane**. Segment 3 includes Bountiful City Pond (ML-8) and a residential neighborhood south of 1100 West (R-9 through R-18) (Figure 4.9-3). Residences are also located north of Porter Lane (ML-9) and South of Parish Lane (ML-10). As with Segments 1 and 2, the remaining land in Segment 3 is primarily undeveloped.

- **Segment 4: Parrish Lane to Glovers Lane**. North of Parrish Lane, Segment 4 is characterized by relatively undeveloped areas (ML-11) with scattered commercial and industrial facilities interspersed (Figure 4.9-4). There are no residences between Parrish Lane and Glovers Lane to the north; however several scattered residences (ML-12) and Glovers Lane Park (ML-13) are located in the vicinity of Glovers Lane and 650 West. The Farmington Bay Wildlife Management Area (FBWMA) is also located in Segment 4.

- **Segment 5: Glovers Lane to US-89/I-15 Interchange (Glovers Lane to Northern Terminus Alternative B only)**. As depicted in Figure 4.9-5, for Alternatives A, C, D, E and the east leg of B, Segment 5 extends between Glovers Lane and the US-89/I-15 interchange. In this segment, there is a

Table 4.9-2 Modeled Noise Levels at Sensitive Receptors

					Alternative A			Alternative B			Alternative C			Alternatives D and E		
Receptor	Number of Dwelling Units	Other Land Use Descriptor	Modeled Existing Sound Level (L_{eq})	Existing SL or SE	Modeled Sound Level (2020 L_{eq})	Change From Existing	Noise Impact (Approach SL or SE)	Modeled Sound Level (2020 L_{eq})	Change From Existing	Noise Impact (SL or SE)	Modeled Sound Level (2020 L_{eq})	Change From Existing	Noise Impact (SL or SE)	Modeled Sound Level (2020 L_{eq})	Change From Existing	Noise Impact (SL or SE)
Segment 1: I-215 to 900 North																
ML-1	6		67	SL	67	0	SL	68	1	SL	67	0	SL	69	2	SL
ML-2	7		53	No	56	3	No	72	19	Both	56	3	No	55	2	No
ML-3	2		56	No	59	3	No	65	9	SL	59	3	No	58	2	No
ML-4	—	Industrial	57	No	76	19	Both	63	6	No	73	16	Both	73	16	Both
ML-5	—	Undeveloped	50	No	80	30	Both	—	—	—	76	26	Both	76	26	Both
R-1	7		54	No	57	3	No	58	4	No	57	3	No	58	4	No
R-2	3		54	No	57	3	No	59	5	No	58	4	No	58	4	No
R-3	3	Foxboro Development	47	No	72	25	Both	69	22	Both	73	26	Both	73	26	Both
R-4	3	Foxboro Development	48	No	73	25	Both	72	24	Both	72	24	Both	73	25	Both
R-5	3	Foxboro Development	52	No	77	25	Both	75	23	Both	71	19	Both	72	20	Both
R-6	3	Foxboro Development	43	No	67	24	Both	66	23	Both	67	24	Both	68	25	Both
R-7	3	Foxboro Development	43	No	68	25	Both	67	24	Both	67	24	Both	68	25	Both
R-8	3	Foxboro Development	44	No	69	25	Both	68	24	Both	67	23	Both	67	23	Both
Segment 2: 900 North to 1200 North																
ML-6	1		50	No	69	19	Both	66	16	Both	64	14	SE	69	19	Both
ML-7	5		44	No	68	24	Both	73	29	Both	78	34	Both	78	34	Both
Segment 3: 1200 North to Parrish Lane																
ML-8	—	Bountiful City Pond	46	No	70	24	Both	78	32	Both	78	32	Both	78	32	Both
ML-9	6		41	No	73	32	Both	66	25	Both	68	27	Both	74	33	Both
ML-10	3		48	No	74	26	Both	71	23	Both	74	26	Both	75	27	Both
R-9	2		40	No	67	27	Both	66	26	Both	68	28	Both	67	27	Both
R-10	3		40	No	65	25	Both	65	25	Both	67	27	Both	66	26	Both
R-11	2		40	No	64	24	SE	64	24	SE	66	26	Both	65	25	Both
R-12	2		39	No	63	24	SE	64	25	SE	65	26	Both	64	25	SE
R-13	3		40	No	64	24	SE	65	25	Both	66	26	Both	65	25	Both

Receptor	Number of Dwelling Units	Other Land Use Descriptor	Modeled Existing Sound Level (L_{eq})	Existing SL or SE	Alternative A			Alternative B			Alternative C			Alternatives D and E		
					Modeled Sound Level (2020 L_{eq})	Change From Existing	Noise Impact (Approach SL or SE)	Modeled Sound Level (2020 L_{eq})	Change From Existing	Noise Impact (SL or SE)	Modeled Sound Level (2020 L_{eq})	Change From Existing	Noise Impact (SL or SE)	Modeled Sound Level (2020 L_{eq})	Change From Existing	Noise Impact (SL or SE)
R-14	2		40	No	65	25	Both	65	25	Both	67	27	Both	66	26	Both
R-15	3		38	No	62	24	SE	63	25	SE	64	26	SE	63	25	SE
R-16	2		39	No	63	24	SE	64	25	SE	65	26	Both	64	25	SE
R-17	2		41	No	65	24	Both	66	25	Both	67	26	Both	66	25	Both
R-18	2		41	No	67	26	Both	66	25	Both	68	27	Both	67	26	Both
Segment 4: Parrish Lane to Glovers Lane																
ML-11	—	Undeveloped	48	No	70	22	Both	74	26	Both	70	22	Both	69	21	Both
ML-12	3		60	No	73	13	Both	62	2	No	73	13	Both	72	12	Both
ML-13	—	Glovers Park	56	No	66	10	Both	66	10	Both	66	10	Both	65	9	SL
ML-14	6		62	No	72	10	Both	—	—	—	72	10	Both	71	9	SL
Segment 5: Glovers Lane to US-89/I-15 Interchange (Glovers Lane to Northern Terminus, Alternative B Only)																
ML-15	12		44	No	—	—	—	75	31	Both	—	—	—	—	—	—
ML-16	6		58	No	—	—	—	72	14	Both	—	—	—	—	—	—
ML-17	8		49	No	—	—	—	76	27	Both	—	—	—	—	—	—
R-19	1		48	No	—	—	—	69	21	Both	—	—	—	—	—	—
R-20	1		44	No	—	—	—	71	27	Both	—	—	—	—	—	—

Notes:
SL = sound level impact (approaches or exceeds 65 dB[A])
SE = substantial exceedance (greater than 10 dB[A] increase over existing conditions)
ML = monitoring location
R = noise model receptor location
— = receptor not applicable to the alternative

residential development south of Clark Lane just east of 650 West (ML-14). The remaining land is primarily undeveloped.

Since the west leg of the Alternative B alignment extends north and west of the other build alternatives, the receptors potentially affected by the alternative are slightly different. A new residential development, Farmington Ranches, is located in this expanded area at the west end of Clark Lane (ML-15) (Figure 4.9-6). Scattered residences are also located along Glovers Lane (R-19 and R-20) and north of Farmington Ranches (ML-16). The remaining land is primarily undeveloped, including the northern terminus (ML-17).

No-Build Alternative

Existing Conditions (2004)

No project-related noise impacts would occur under the No-Build Alternative. Noise levels illustrated in Table 4.9-2 under existing conditions would continue as described.

Future Conditions (2020)

If none of the build alternatives is implemented, future projects will likely be undertaken to improve access to land in the project area, although the nature and timing of these projects are not known at this time. It is likely that these future projects would result in increased noise from traffic and human use in the study area.

Build Alternatives

The impacts discussion presented below for each of the build alternatives includes sound-level changes at the representative receptor locations listed in Table 4.9-2 and the total number of affected residences, including platted lots, located within the 65-dB contour.

Alternative A

Modeled sound levels and project-related impacts under Alternative A are shown in Table 4.9-2. Depending on receptor location relative to the proposed alignment, modeled sound levels would increase by 0 to 32 dB(A) as a result of Alternative A. About 486 residences, including platted lots, in the 65-dB contour would be affected. Noise levels in the vicinity of these residences would increase between 10 and 32 dB(A), and this outcome would represent a substantial exceedance of the NAC (see Section 4.9.1.3).

Alternative B

Modeled sound levels and project-related impacts under Alternative B are shown in Table 4.9-2. As with Alternative A, modeled sound levels would increase between 1 and 32 dB(A) as a result of Alternative B, depending on receptor location relative to the proposed alignment. About 250 residences, including platted lots, in the 65-dB contour would be affected. Noise levels in the vicinity of these residences would increase between 10 and 32 dB(A); such levels would represent a substantial exceedance of the NAC.

Alternative C

Modeled noise levels and project-related impacts under Alternative C are shown in Table 4.9-2. Under Alternative C, modeled sound levels would increase between 0 and 34 dB(A), depending on receptor location relative to the proposed alignment. About 203 residences, including platted lots, in the 6 5dB-

contour would be affected. Noise levels in the vicinity of these residences would increase between 10 and 34 dB(A) over existing noise levels, and this result would represent a substantial exceedance of the NAC.

Alternatives D and E

Modeled sound levels and project-related impacts under Alternatives D (Final EIS Preferred Alternative) and E are shown above in Table 4.9-2. Under Alternatives D and E, modeled sound levels would increase between 2 and 34 dB(A), depending on receptor location relative to the proposed alignment. About 431 residences, including platted lots, in the 65-dB contour would be affected. Noise levels in the vicinity of these residences would increase between 10 and 34 dB(A); such levels would represent a substantial exceedance of the NAC.

Summary of Receptors Affected by Noise

Table 4.9-3 summarizes by alternative the number of receptors that would exceed the NAC standard (67 dB[A]) or result in a substantial exceedance of the NAC standard (e.g., an increase of greater than 10 dB[A] over existing conditions) in the modeled year 2020.

Table 4.9-3 Total Number of Modeled Receptors Affected by Proposed Build Alternatives

Alternative	Total Number of Modeled Receptors	Number of Receptors with SL Impact[1]	Number of Receptors with SEs[2]	Total Number of Receptors Affected [3]
No-Build Alternative	37	1	NA	1
Alternative A	32	23	27	28
Alternative B	35	27	29	31
Alternative C	32	26	27	28
Alternatives D and E	32	25	25	28

Notes:

SL = sound level impact

SE = substantial exceedance

[1] An SL impact occurs anytime noise levels at a receptor approach or exceed 65 dB(A). For all build alternatives, this impact would occur at modeled year 2020.

[2] An SE occurs anytime the noise level increases more than 10 dB(A) over existing conditions.

[3] Represents total number of modeled receptors with either an SL impact or an SE.

4.9.3.2 Noise Abatement Measures

Noise Abatement Criteria

This section discusses methods for abating the operational traffic noise impacts identified in the previous section. Noise abatement for construction-related noise impacts is discussed in Section 4.20.3.3 of this document. According to the UDOT noise abatement policy in effect at the time this analysis was completed (UDOT 08A2-1, April 2000), noise abatement will be considered for Type I projects (i.e., new highway construction) where traffic noise impacts are identified. To be eligible for consideration of noise

abatement measures, a new or proposed subdivision or other development must have a recorded plat prior to the earliest of the following occurrences.

- The earliest environmental approval date of the highway improvement as per completion of Activity 79d (Record of Decision [ROD] for an EIS) or Activity 67d (prepare final environmental document) of the UDOT *Design Process Manual*.
- The date that the local municipality's general plan or master plan has designated the highway for major improvements.

The following noise abatement measures can be included to reduce impacts from traffic noise.

- Traffic management measures (such as restricting vehicle speeds and prohibiting compression braking).
- Altering horizontal and vertical alignments (for example, depressing roadway alignments to create shielding effects).
- Constructing noise barriers when reasonable and feasible.
- Installing noise insulation in public-use or nonprofit institutional buildings.

Because the proposed roadway would act as a primary north-south connector between I-215 in Salt Lake City and the northern terminus at I-15 in Farmington, substantial speed restrictions would not meet the overall objectives of the project. Altering horizontal and vertical alignments would not be feasible because of the costs associated with excavations, other geotechnical considerations, and the potential for additional impacts on wetland areas. As a result, this section focuses on considering noise barriers as a primary means of abating project-related noise impacts.

According to the UDOT noise abatement policy (08A2-1, April 2000), several factors go into the determination of whether noise abatement measures, and specifically, noise barriers, are reasonable and feasible for abating noise impacts. These factors include the following.

- **Effectiveness of noise barrier**. The noise barrier has to achieve at least 5 dB(A) of exterior noise reduction at typical affected residences nearest the roadway.
- **Cost to install noise barrier**. The cost per residence to install a noise barrier (based on the severity of the noise impact, i.e., the increase in project-related noise levels over existing noise levels), not including other direct costs (e.g., acquiring new right-of-way, landscaping), must not exceed the abatement limit established for the project. At the time of this analysis, the noise abatement limit was based on a standard noise barrier 3 m high by 70 m long (10 ft high by 230 ft long) at an installed cost of $107.64 per square meter, or $10.00 per square foot (Adams pers. comm.). The noise abatement limit of $22,604 for this analysis was calculated based on the number of residences that would benefit (i.e., receive an improvement of at least 5 dB[A]) from construction of a noise barrier. This figure represents an increase from the abatement limit of $20,000 disclosed in the Final EIS.
- **Views and opinions of affected residents**.
- **Engineering considerations**. Engineering considerations such as abatement design, performance, and roadway safety must be taken into account.

The effectiveness of noise barriers is generally limited to areas within about 152 m (500 ft) of the proposed right-of-way. Beyond this distance, barriers do not effectively reduce noise levels at individual residences. Therefore, the noise abatement analysis was limited to those areas adjacent to each alignment where clustered residences would potentially benefit from the barrier (i.e., achieve at least a 5-dB[A] reduction in project-related noise levels) and would meet the UDOT cost-effectiveness criteria. The selection of feasible noise barrier locations is described in the following section.

Selection of Feasible Noise Barrier Locations

Based on aerial photographs of land uses in the study area, seven locations were evaluated to determine whether noise barriers would be feasible and effective, given noise levels associated with specific build alternatives (indicated in parenthesis). As described below, noise barriers were considered potentially feasible at three of these locations (R-3 through R-8, ML-7, and ML-2).

The potential locations for noise barriers evaluated in this document are different than those evaluated in the Final EIS. The differences are attributable to updated noise monitoring data; application of the revised FHWA TNM (versus the STAMINA model used for the Final EIS), which takes into consideration terrain features, the height of the highway embankment, and the shielding effects of intervening rows of residences; and application of UDOT's revised Noise Abatement Policy.

- **Residences near ML-3: (Alternative B)**. The Alternative B alignment passes residences near ML-3 (Figure 4.9-1). Although the alignment does not lie within 152 m (500 ft) of these residences (i.e., the limit to which barriers are typically considered effective), a noise barrier was modeled near ML-3 to determine its noise abatement potential. It was determined that a barrier at this location would not provide the 5 dB(A) of noise reduction required by UDOT's Noise Abatement Policy. As a result, a barrier at this location was eliminated from consideration.

- **Residences near ML-9 (Alternatives A, D, and E)**. The Alternatives A, D, and E alignments pass residences near ML-9 (Figure 4.9-3). Although these alignments do not lie within 152 m (500 ft) of these residences, a noise barrier was modeled near ML-9 to determine its noise abatement potential. It was determined that a barrier at this location would not provide the 5 dB(A) of noise reduction required by UDOT's Noise Abatement Policy. As a result, a barrier at this location was eliminated from consideration.

- **Residences near ML-15 and ML- 17 (Alternative B)**. As described in Section 4.9.3.1, Alternative B passes through a relatively new residential development (Farmington Ranches) that was platted after the original ROD for Legacy Parkway was completed (October 1, 2000). The local jurisdiction made land use planning decisions following selection of Alternative D (Final EIS Preferred Alternative), and did not take into consideration that a supplemental environmental process could result in selection of an alignment at a different location, including that associated with Alternative B. Construction of noise barriers in the vicinity of ML-15 and ML-17 (Figure 4.9-6) would require the removal of more than 20 residences, as well as a middle school and possibly a church. As a result, noise barriers were not modeled and are not considered feasible at this location.

- **Residences near R-9 through R-18 (Alternative A)**. The Alternative A alignment passes within 244 m (800 ft) of the residential neighborhood south of 1100 West (R-9 through R-18). A noise barrier was modeled near these receptors to determine its potential effectiveness. It was determined that a barrier at this location would not provide the 5 dB(A) of noise reduction required by UDOT's Noise Abatement Policy. As a result, a barrier at this location was eliminated from consideration.

- **Residences near R-3 to R-8 (All Alternatives)**. All the proposed build alternatives pass residences near R-3 through R-8 (Figure 4.9-1) (the Foxboro development). The noise model demonstrated that a noise barrier at this location could be feasible. The following section describes how a noise barrier at this location would function under each of the build alternatives.

- **Residences near ML-7 (Alternative B, C, D, and E)**. Alternatives B, C, D, and E pass residences near ML-7, which is located on 1200 North, near the Davis County sewage plant (Figure 4.9-2). The noise model demonstrated that a noise barrier at this location could be feasible under some of the alternative alignments. The following section describes how a noise barrier at this location would function under those build alternatives.

- **Residences near ML-2 (Alternative B)**. The Alternative B alignment passes residences near ML-2, which is located south of center Street and east of 2200 West (Figure 4.9-1). The noise model demonstrated that a noise barrier at this location could be feasible. The following section describes how a noise barrier at this location would function under Alternative B.

- **Recreational Locations (All Alternatives)**. There are several recreational resources located throughout the project corridor including the Jordan River OHV Center, Bountiful City Pond, the FBWMA, and Glovers Lane Park. Noise abatement measures for recreational resources are considered for those areas where "frequent human use occurs and a lower noise level would be of benefit" (23 CFR 772.11). The recreational facilities located near the proposed build alternatives are active facilities and are generally associated with higher noise levels. Relatively noisy activities are associated with both Bountiful City Pond and the FBWMA (e.g., boating, hunting). In addition, Bountiful City Pond is located next to an active landfill (i.e., an industrial noise source), which also contributes to the noise environment at the pond. Glovers Lane Park includes a baseball field and is located adjacent to an arterial with pass-by traffic. Finally, all the recreational resources are affected to some extent by aircraft overflights from the Salt Lake City International Airport. For all these reasons, a pristine noise environment is not a significant attribute of the recreational resources in the study area. It is unlikely that there would be any benefit from implementation of noise abatement measures in these locations. Chapter 5, *Section 4(f) and 6(f) Evaluation*, provides an additional discussion of noise impacts on recreational resources in the study area that qualify for protection under Section 4(f) of the Department of Transportation Act of 1966. Receptor locations for these resources, shown on Figures 4.9-1, 4.9-3, 4.9-4, and 4.9-5, are noted by R' (R'-1, -2, -3, and -4).

Noise Barrier Analysis by Alternative Alignment

This section evaluates the effectiveness and feasibility of noise barriers in the three residential locations that, according to the model, would likely benefit from the implementation of noise abatement measures (e.g., residences near R-3 through R-8, ML-7, and ML-2). This discussion is presented by build alternative. Potential noise abatement for construction activities is also described.

Alternative A

Residences near R-3 through R-8 (Foxboro Residential Development)

The Foxboro development was platted in 2003 after the original ROD for Legacy Parkway was completed (October 31, 2000). According to UDOT's Noise Abatement Policy, because the development was platted after the ROD was issued, the development is not eligible for noise barriers.

Residences near ML-7

Under Alternative A, the proposed alignment would be more than 152 m (500 ft) from these residences; therefore, a noise barrier was not modeled at this location for this alternative.

Residences near ML-2

Under Alternative A, the proposed alignment would be more than 152 m (500 ft) from these residences; therefore, a noise barrier was not modeled at this location for this alternative.

Alternative B

Residences near R-3 through R-8 (Foxboro Residential Development)

As described for Alternative A, the Foxboro development was platted in 2003 after the original ROD for Legacy Parkway was signed (October 31, 2000) ; therefore, the development is not eligible for consideration of noise barriers.

Residences near ML-7

The Alternative B alignment would be located approximately 200 m (656 ft) closer to residences near ML-7 than under Alternative A. However, a noise barrier at this location, modeled at a height of 10 m (32.8 ft), would not provide an acoustic benefit of 5 dB(A) or more, and would, therefore, not meet UDOT's feasibility criteria.

Residences near ML-2

The Alternative B alignment would pass within 152 m (500 ft) of a group of residences near the southern terminus of the project, east of 2200 West (near ML-2). A noise barrier was modeled in the vicinity of these residences (Figure 4.9-1), and noise barrier heights were evaluated to determine what height would provide the most cost-effective abatement for affected receptors (i.e., the point at which increasing the height further would not provide more acoustic benefit).

At this location and under this alternative, a noise barrier 377 m (1,237 ft) long and 5 m (16.4 ft) high would provide an acoustic benefit to five residences at a cost of $202,900. The cost per dwelling of $13,527 would be less than the abatement limit ($22,600 per affected residence). Therefore, a noise barrier at this location would be reasonable and feasible according to UDOT's Noise Abatement Policy. Table 4.9-4 summarizes the proposed use of a barrier at this location if Alternative B is implemented.

Table 4.9-4 Noise Abatement for Legacy Parkway

Location	Noise Levels (No Barrier)	Noise Levels (With Barrier)	Change in Noise Levels	Wall Height (m)	Wall Length (m)	Cost of Barrier	Cost per Residence	Meets UDOT Noise Abatement Criteria
Alternative B								
Residences Near ML-2 (2200 West)	73 to 75	67 to 69	4 to 7	5	377	$202,900	$13,527	Yes
Alternative C								
Residences near ML-7 (1200 North)	69 to 71	63 to 66	5 to 6	5	225	$121,095	$10,031	Yes

Alternative C

Residences near R-3 through R-8 (Foxboro Residential Development)

As described for Alternative A, the Foxboro development was platted in 2003 after the original ROD for Legacy Parkway was signed (October 31, 2000); therefore, the development is not eligible for consideration of sound walls.

Residences near ML-7

The Alternative C alignment would pass within 152 m (500 ft) of the residences near ML-7 at 1200 North. At this location and under this alternative, a noise barrier 225 m (738 ft) long and 5 m (16.4 ft) high would provide an acoustic benefit to four residences at a cost of $121,095. The cost per dwelling of $10,091 (based on the severity of the noise impact) would be less than the abatement limit ($22,600 per affected residence). Therefore, a noise barrier at this location, as illustrated in Figure 4.9-2, would be reasonable and feasible according to UDOT's Noise Abatement Policy. Table 4.9-4 summarizes the proposed use of a barrier at this location if Alternative C is implemented.

Residences near ML-2

Under Alternative C, the proposed alignment would be more than 152 m (500 ft) from these residences, so a noise barrier was not modeled at this location.

Alternatives D and E

Residences near R-3 through R-8 (Foxboro Residential Development)

As described for Alternative A, the Foxboro development was platted in 2003 after the original ROD for Legacy Parkway was signed (October 31, 2000); therefore, the development is not eligible for consideration of sound walls.

Residences near ML-7

The alignments of Alternatives D and E would pass within 152 m (500 ft) of one residence on 1200 North, in the vicinity of ML-7. At this location and under this alternative, a noise barrier 1 to 10 m (3.3 to 33 ft) high and about 350 m (1,148 ft) long would provide acoustic benefit to only that one residence, at a cost of between $37,674 and $376,740. Such cost exceeds the UDOT cost abatement limit of $22,600 per affected residence, making a noise barrier at this location infeasible according to UDOT's Noise Abatement Policy.

Residences near ML-2

Under Alternatives D and E, the proposed alignment would be more than 152 m (500 ft) from these residences, so a noise barrier was not modeled at this location.